[redacted]

[redacted]

3559

Country - Belgium
Subject - Specifications of the Circular Aircraft Hangars at Grimbergen Airfield
Place Acquired - ------
Date Acquired - [redacted] 25X1A6a
Date of Information - 1949-May 1953

25X1X6 [redacted]

1. Grimbergen Airfield near Brussels is intended generally for the use of light and training aircraft. It is the site of Belgium's civilian flying school.

2. There are two circular hangars at Grimbergen. One feature of a training field is that the planes do not leave on any planned schedule. When the hangars are rectangular, the machine needed first may be the one at the very back of the hangar. Circular hangar construction overcomes this difficulty. The aircraft are housed with their tails toward the center. The double-tracked sliding door system can be opened at any point so that any plane can be brought out at a moment's notice. An element of runway must be maintained, of course, around each hangar.

3. The hangars at Grimbergen are 50 meters in diameter. Designed expressly for small aircraft, they can house up to 35 Piper Cubs and twin-engine Percivals. They were built by Messrs. Blaton-Aubert, Brussels, on detailed designs by M. Chaikes, from patents owned by M. Hardy of Quievrain, Belgium.

4. Apart from their aluminum and glass sliding doors, each hangar looks like a large concrete mushroom on a squat, hollow stalk. The top of the mushroom is hollowed by the down-slope of the roof from the circumference rather more than half-way to the center, inside which it rises in a low dome crowned by a glazed lantern top.

5. The base of the dome is a circle, 11 meters in radius, from which the edge of the mushroom slopes upwards and outwards for another 14 meters. The slope of the mushroom edge is 14^{0} to the horizontal, rising to a maximum height of seven meters at the circumference. The dome is a segment of a sphere, 22 meters in radius, the tangent in the vertical plane at the point of intersection, with the mushroom edge being inclined 30^{o} to the horizontal. The intersection forms, on the under side of the roof, a circular girdle 60 cm thick - the hollow stalk of the mushroom. This is hollowed into four low arches. The girdle is 1.20 meters deep at the top of the arches and 1.75 meters deep at the thickest points, at which it rests on the four support pillars. These pillars are the only support of the roof; the mushroom edge has no other pillars to support it and no struts or girders. Thus, there is plenty of headroom and no obstruction of access to any point in the 1,584 sq m. of main hangar space under the mushroom edge. The additional area, the space under the dome, is 380 sq. m.

[redacted]

6. Apart from the glazed lantern, the entire structure is built of reinforced concrete, none of which is pre-cast. The super-structure is in one piece, laid on an arrangement of radial and circumferential (annular) reinforcement bars.

7. There is no deflection in the mushroom edge. The radial and hoop reinforcements are complementary in absorbing the moments of deflection and torsion. The thickness of the concrete in the dome is 8 cm, in the mushroom edge 10 cm, thickening to 12 cm in the portion approaching the girdle.

8. The annular reinforcement bars are laid in groups roughly calculated to absorb strain moments at the points in question. In the mushroom edge, in the thicker concrete near the girdle, there are 18 bars of 16 mm in the first meter and 14 bars of 16 mm in the second meter. Outward from that point, the bars are of 20 mm caliber, at a frequency of six to the meter for two meters, seven to the meter for four meters, and thereafter eight to the meter. The last half-meter, at the circumference, presents a special problem since the concrete must be thickened to bear the additional weight of the runway for the sliding doors. The weight of concrete in this section is 370 kg per meter-run so that, with the door-runway and allowance for surcharge weight, 470 kg must be allowed for, at a mean radius of 24 3/4 meters. The circumferential tension is thus given:

$$H = hr$$

$$= \frac{pr}{\tan \alpha}$$

$$= \frac{470 \times 24.75}{\tan 14^\circ} = 46.2 \text{ tons}$$

Allowing for a tension of 1.2 tons per cm^2 of bar-section, this calls for a total section of 38.5 cm^2, which is approximately satisfied by 13 Ø 20 mm. The outermost half-meter is therefore reinforced with no less than 13 annular bars 20 mm in diameter.

9. The stability of the roof thus assured, the next point is the stability of the structure. At the junction of the dome and the mushroom-edge there is, of course, an offsetting of the lateral compression stresses. Unfortunately, the difference between the tangents of 30° (at which the dome comes in) and 14° (the slope of the mushroom edge) results in minimizing the extent of the compensation. The horizontal in-thrust from the mushroom edge is 38.4 tons per meter-run, while the out-thrust from the dome is only 2.95 tons per meter-run. The result is therefore an inward thrust of 35.45 tons per meter-run.

10. The total weight of the structure is 800 tons. The roof is drained of rain water by four drainage pipes which run down the inward side of the support columns. The hollowed-out roof could, if necessary, be used as a water reservoir or as a store for sand. Allowance has been made for a surcharge weight of 100 kg per square meter, bringing the total weight above ground to a thousand tons. Allowing for the below-ground weight, the total weight at the foundation is 303 tons for each of the four support columns.

11. These columns are essentially rectangular posts 4.26 meters long and 25 cm thick, each end thickening to 75 cm, the end-faces being trim to the line of the radius of the hangar circle. Below ground each column rests on a 75 cm section continuation pillar which continues to a depth of 40 cm, after which it is broadened out to a base 65 cm below. This base is 2.50 m broad and seven m long, at a tangent to the curve of the girdle. This 17 1/2 sq m of foundation-foot results in pressure at the foundation of about 1 1/2 kg per sq cm.

12. The support columns stand above floor-level to a height of 2.30 meters. The low arches in the girdle are such that the highest point is 2.85 m above floor-level, but a foot inside or outside the archway there is a full four m of headroom. The central space under the dome, though available for hangar space as necessary, lacks the immediate accessibility which is the main advantage of the outer periphery. It is considered mainly as workshop space. It gets much of its light from the lantern top in the dome, where there is also a ventilation opening.

13. The application of the design of the Grimbergen hangars to accommodate the large wing span of modern commercial aircraft might result in hangars that were cumbrously large. At Grimbergen they have been a complete success.

-end-